PYROLYSIS-GC-MS ANALYSIS OF ORGANIC MATTER FRACTIONS CONTROLLING SOIL WATER REPELLENCY

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Soil water repellency (WR) is a property that reduces affinity for water and therefore infiltration capacity having a major impact on hydrological, geomorphological and geochemical soil processes (Jordán et al., 2013). Soil WR is widely observed in different climatic conditions, soil types and vegetation covers (Doerr et al., 2000). In the Mediterranean area, evergreen trees such as pines and oaks as well as shrubs are usually associated with the occurrence of soil WR (Doerr et al., 2000).

Soil WR is conditioned by different biotic and abiotic variables. It has been usually related with soil organic matter (SOM) content (DeBano, 2000; Doerr et al., 2000; Mataix-Solera et al., 2013; Zavala, 2014). However this relationship could be due to specific compounds within the SOM pool. The origin of natural WR has been attributed to organic compounds released from different plant species and sources (resins, waxes and other organic substances; Rumpel et al., 2004). In fact, soil lipids released by plants or microorganisms play a relevant role on the development of WR (Lozano et al., 2013).

This paper attempts to enlighten the relationship between soil WR, SOM content and the possible effects of the relative abundance and molecular assemblage of specific hydrophobic substances (*n*-alkane/alkene pairs and *n*-alkanoic acids) present in SOM.

Soil samples (0-10 mm depth) were collected in Doñana National Park (Huelva, SW Spain) under four different vegetation types dominated by: *Quercus suber* (QS), *Pteridium aquilinum* (PA), *Pinus pinea* (PP) and *Halimium halimifolium* (HH). Soil samples were divided in different aggregate sieve fractions (1-2, 0.25-1, 0.05-0.25 and <0.05 mm), SOM measured and each sieve fractions studied by pyrolysis gas chromatography mass spectrometry (Py-GC/MS).

A positive exponential correlation was found between SOM and WR as measured by the water drop penetration test (WDPT). The effect of SOM on WR was particularly evident in all sizes fractions QS sample and the smaller sieve fractions (<0.05mm) in all samples (Figure 1).

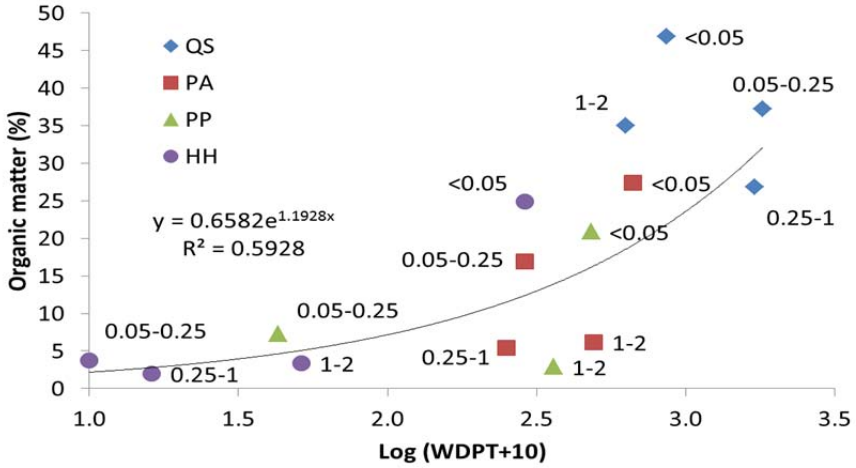

Figure 1.Organic matter content *vs.* soil water repellency (Log_{10}(WDPT+10)).

Long chain fatty acids released by pyrolysis seem to be related to soil the water repellency observed in the soil sieve fractions; these appear in all water-repellent sieve fractions under different vegetation types while not present in wettable or critically water-repellent (0.25-1 and 0.05-0.25 mm sieve fractions from soil samples under HH; Table 1).

PA and PP samples show a similar degree of water repellency, having also similar long-chain fatty acids and alkane patterns (CPI-L). This may be explained by the presence of inherited organic matter from PP in soils under PA, or inputs either by wind or runoff water.

Table 1. Soil water repellency (mean WDPT, seconds), organic matter content (OM, %), *n*-alkane long-chain carbon preference index (CPI-L), *n*-alkane average chain length (ACL), and number of long-chain fatty acids (LC-FAP). Size fractions: 1 (1-2 mm), 2 (0.25-1 mm); 3 (0.05-0.25 mm), 4 (<0.05 mm).

Vegetation type	**QS**				**PA**			**PP**			**HH**			
Sieve fraction	1	2	3	4	1	3	4	1	3	4	1	2	3	4
Mean WDPT	619	1692	1800	852	480	278	656	350	33	471	41	6	0	278
OM	35	26.8	37.2	46.9	6.2	17	27.4	2.9	7.3	21	3.4	2	3.7	25
CPI-L	1.5	1.3	1.3	1.4	1.6	1.3	1.4	2	1.3	1.4	1.4	1.9	1.1	1.2
ACL	19.3	18.5	18.6	18.2	17.3	16.7	16.6	16.5	17.1	16.4	19	17	18.1	18
LC-FAP	1	2	3	1	3	2	1	5	1	1	2	0	0	0

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